

## ENDAMOEBIA HISTOLYTICA AND CERTAIN OTHER PROTOZOAN ORGANISMS FOUND IN COCK- ROACHES IN CAIRO, EGYPT<sup>1, 2, 3</sup>

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### INTRODUCTION

A large number of organisms, both pathogenic and non-pathogenic have been found in the colon and feces of cockroaches. Experimentally, the causal organisms of tuberculosis, leprosy, cholera and common enteric pathogens have been retained in a viable state in the colons of roaches (Reed 1933; Mosier 1946; Akkerman 1933; Jansen, 1952). Moiser (1946) in Southern Rhodesia found that 23 per cent of the roaches caught in the thatched huts of patients at a leprosy hospital contained leprosy bacilli.

*Staphylococcus albus* was isolated in pure culture from the hemolymph of *Blatta orientalis* L. from Mississippi by Tauber and Griffiths (1942). Coxsacki virus was fed to *Periplaneta americana* L. by Fisher and Syverton (1951) and fecal specimens obtained daily for a period of 15 days contained sufficient virus to paralyze mice.

Similarly, roaches are known to harbor several species of protozoan organisms in the colon. One such organism is *Endamoeba histolytica* Schaud., the protozoan causing amoebic dysentery. Amoebic dysentery is endemic in Egypt, and the practice of building toilet openings flush with the floors affords roaches an opportunity to feed upon human feces. The purpose of this investigation was to determine the importance of roaches in the

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spread of *E. histolytica* in this area, and to record certain other protozoa found in the colons of these insects.

#### PERTINENT LITERATURE ON PROTOZOA

FLAGELLATES: *Giardia intestinalis* (Lambl) cysts apparently pass unharmed through the colon of *Periplaneta americana* according to Mackfie (1922). Pessôa and Corrêa (1927) working experimentally with this organism have shown that the cysts may be disseminated by various stages of *Blattella germanica* L., *Periplaneta americana* and *Rhyparobia* (*Panchlora*) *maderae* F. The cysts were found in the excreta in the greatest numbers for forty-eight hours after ingestion, but a few were present for seven days. The cysts of *Lambli*a were recovered by Tejera (1926) 24 hours after they were fed to roaches. Young (1937) working with *P. americana*, *P. brunnea* Burm. and *Eurycotis floridana* Wlk. found that the cysts may reach the colon in two or three hours, and remain there, in the case of *Periplaneta* for 12 days.

Yakimoff and Miller (1922) found *Lophomonas striata* Bütschli and *L. blattae* in *B. orientalis*.

AMOEBAE: Among the organisms of the order Amoebina found in cockroaches, Lucas (1927) described *Entamoeba thomsoni* and *Endolimax blattae* from the hindgut of *B. orientalis* and *P. americana*. *Entamoeba thomsoni* L. was cultivated from *P. americana* by Smith and Barret (1928). *Entamoeba blattarum* was noted in the intestine of *B. orientalis* by Yakimoff and Miller (1922). Morishita and Tsuchimochi (1926) found in feeding experiments that the cysts of *Entamoeba pitheci* Prowazek were passed in the feces of *P. americana*, *P. australasiae* (F) and *Dorylaea rhombifolia*.

Human feces containing cysts of *Entamoeba histolytica* Schaud. and *E. coli* (Grassi) were fed to *P. americana* by Macfie (1922). Cysts were found in the feces for one to three days in seven of nine experiments. He concluded that "It would seem, that cysts of *E. histolytica* and *E. coli* can pass through the intestines of cockroaches without injury, and may thus be disseminated by these insects, but that they do not produce an actual infection in these hosts." Tejera in 1926, according to Fry and Meleney (1936) found live cysts of *E. coli* in cockroaches caught in a latrine, and cysts resembling those of *E. histolytica* in the

feces of those caught in a kitchen near a closet drain. Cultures of *E. histolytica* were fed to *P. americana* by Fry and Meleney (1936) and cysts of the parasite were found in the gut or droppings of all roaches fed. The cysts remained in the crop for some time, but after four to eight hours the majority of them were found in the anterior and middle portion of the intestine, and after 16 hours, in the hind gut. They appeared in the droppings in from 16 to 20 hours. Cysts were found in the hind gut 72 hours after feeding. The authors obtained growth in culture from cysts collected from droppings obtained after 48 hours. Their conclusions were that "it seems quite possible that cockroaches which have access to human feces containing cysts of *E. histolytica*, may under certain conditions contaminate food with their droppings, and thus act as passive transmitting agents of this organism." Schneider and Shields (1948) in Talara, Peru cultured the legs and intestinal contents of 100 roaches in a search for viable cysts of *E. histolytica*. None were found in the leg cultures, but they were found in seven percent of the cultures from the intestinal tracts. The authors concluded that food and utensils can be contaminated by viable forms of *E. histolytica* from the feces of cockroaches, and that the common roach can be incriminated as a carrier of the parasite in Peru.

#### PROCEDURE AND DISCUSSION

Collection of roaches: The traps utilized consisted of 500 ml. beakers, the insides of which were greased with vegetable shortening to prevent the roaches from escaping. Gauze ramps were used to facilitate entry into the traps. They were baited with cooked raisins (Webster and De Coursey 1954). These traps were placed in 53 restaurants in Abbassia and Gamalia in Cairo, Egypt, through the cooperation of the Egyptian Ministry of Public Health and the City Health Department. The roaches had ample opportunity to feed upon human feces, since the latrine openings are flush with the floors, and are not connected to sewers. The roaches hide in the daytime under the latrine openings near the feces, and migrate to the restaurants at night.

Cockroaches, *Blattella germanica*, and *Periplaneta americana* were captured in only 30 of the 53 restaurants because the proprietors, in many cases, sprayed the traps with insecticide, or even covered them to prevent roaches from entering.

*Periplaneta americana* were also captured by hand in the villages of Mit Halfa and Sindbis in a rural area where the incidence of *E. histolytica* was higher. These insects had access to human feces around bored hole latrines and on the ground inside and outside the buildings. Examination of the feces of 100 persons from Sindbis village by Weir et al (1952) showed 93 per cent positive for *E. histolytica* cysts. *Iodamoeba* Dobell sp. *Endolimax nana* (Wen. and O'Con), *Entamoeba coli* and *E. histolytica* were found to be common in human feces in villages in this area by Chandler (1954). Other organisms noted by him were *Dientamoeba fragilis* and *Giardia lamblia* Stiles. He quotes Lawless, D. K. (in a personal communication) as having found *Enteromonas hominis* da F. also to be a common parasite.

**Laboratory Procedure:** The captured roaches were returned to the laboratory, the intestinal tracts removed, and two to four slides prepared from each roach for microscopic study. The slides were fixed with modified Schaudinn's solution and stained with Heidenhain's iron hematoxylin. A search was made for the following protozoan organisms: *Giardia intestinalis*, *Entamoeba histolytica*, *E. coli*, *Dientamoeba*, *Endolimax* (K. and S.) *Iodamoeba*, and *Enteromonas*, all of which are found in human feces in this area. Records were also kept of the occurrence of *Dobellina* sp. *Gregarina blattarum* S., *Entamoeba blattae* (Bütschli), and *Lophomonas blattarum*.

**Protozoa Found in Intestines:** Fifty-six per cent of the roaches from the restaurants were infested with one or more of the organisms listed in Table 1. Those in the villages contained 59 per cent. Only one of the 217 insects taken from the restaurants was infested with organisms morphologically similar to large race *E. histolytica* cysts, and eight, representing six restaurants, with those similar to the small race. Two of the 44 insects captured in the villages, contained organisms similar to the large race and three to the small. The overall percentage of insects containing these parasites is so small, in areas where frequent contact with human feces would be expected, that it is believed that danger of food contamination from this source is not great. In the larger restaurants where adequate sanitation is maintained, roaches would not readily come in contact with feces, and would therefore probably not be a source of contamination.

Other forms normally found in human excrement that were

present in the roaches, resembled *E. coli*, *Iodamoeba* sp., *Endolimax* sp., and *Enteromonas* sp. The number of roaches infested with all of the forms studied are given in Table 1. The organisms: *Endamoeba blattae*, *Gregarina blattarum*, *Lophomonas* sp. and *Dobellina* sp. were recorded only as of possible interest.

TABLE 1.

PROTOZOAN ORGANISMS FOUND IN ROACHES FROM RESTAURANTS AND VILLAGES

Type of Organism	30 Restaurants 217 Roaches		2 Villages 44 Roaches	Total Roaches Infested
	No. Roaches Infested	No. Restaurants with Infested Roaches	No. Roaches Infested	
<i>E. histolytica</i>				
Large race	1	1	2	3
Small race	8	6	3	11
<i>E. blattae</i>	7	5	—	7
<i>E. coli</i>	—	—	1	1
<i>Iodamoeba</i> sp.	50	18	9	59
<i>Endolimax</i> sp.	61	19	13	74
<i>Enteromonas</i> sp.	11	9	4	15
<i>Lophomonas</i> sp.	4	4	3	7
<i>Dobellina</i> sp.	26	12	4	30
<i>Gregarina blattarum</i>	10	5	—	10

## SUMMARY

Various authors have reported the retention of *Endamoeba histolytica* cysts in the intestines of cockroaches both from experiments and from the fecal examination of free living roaches. In the area around Cairo, Egypt, roaches have ample opportunity to become contaminated through contact with human feces.

*Periplaneta americana* and *Blattella germanica* were collected from 30 restaurants in Abbassia and Gamalia. The intestinal contents were examined for the presence of protozoan organisms. Two hundred seventeen roaches were collected. Organisms morphologically resembling *Endamoeba histolytica* large race were found in only one roach. Those of the small race were found in eight roaches taken from six of the thirty restaurants.



Forty-four roaches taken from two rural villages where the incidence of *E. histolytica* has been reported to be much higher, yielded only two roaches with organisms resembling the large race of this parasite, and three roaches with the small race. The small percentage of infested roaches in an area where amoebic dysentery is endemic would seem to indicate that the chance of food contamination from this source is slight.

Other organisms taken from the intestines of roaches were similar to the following: *Endolimax* sp., *Entamoeba blattae*, *E. coli*, *Iodamoeba* sp., *Lophomonas* sp., *Enteromonas* sp., *Dobellina* sp., and *Gregarina blattarum*.

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(Continued from page 156)

presidents in the room and paid tribute to them all. He noted that a small nucleus in the society did most of the work.

He then called on Dr. Treat in his capacity as chairman of the program committee. Dr. Treat announced the following programs:

January 17—Miss Alice Gray will speak on "The Museums Projected Hall of Insects."

February 7—Dr. Berta Scharrer will speak on "Certain Aspects of Insect Endocrinology."

February 21—Dr. T. C. Schneirla will speak on "Behaviour Cycles in Army and Driver Ants."

March 6—Mr. H. J. Williams will speak on "Colour Cinema."

March 20—Dr. Smith of the State University of Pennsylvania will speak on "Control of Insect Flight."

April 3—Mr. Vladimir Alexieff of the Men's Faculty Club of Columbia University will speak on "Entomological Music by Composers."

(Continued on page 164)